Assessing Exposure to War-related Traumatic Events in Older Vietnamese War Survivors

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Abstract

Background: Though studies measuring war-related stressors and resultant trauma among U.S. military veterans are abundant, few studies address how wartime stressors affect military veterans native to warzones. Even fewer assess the stress exposure and resulting trauma experienced by civilians. This study aimed to develop and evaluate a measure of wartime stress exposure relevant for civilians and military veterans who survived the American War in Vietnam.

Methods: The study analyzed data from a novel source, the Vietnam Health and Aging Study, which surveyed older men and women residing in central and northern Vietnam. We used a combination of exploratory and confirmatory factor analysis with posthoc tests of reliability and validity to derive measures for assessing exposure to war-related traumatic events.

Results: We found that a mix of exposure to death, combat, inhospitable living conditions, and forced displacement comprises the traumatic events that potentially contribute to posttraumatic stress disorder and other mental health problems. However, the particular mix of stressful experiences constituting war trauma differs for civilians, veterans of the formal military, and former members of paramilitary organizations.

Conclusions: These findings suggest the need for distinct, but parallel approaches to measuring war-related stressors for populations of veterans and civilians exposed to war in their home countries, and the need for greater public attention to the potential lingering trauma of noncombatants.

Background

The last several decades have witnessed mounting empirical evidence demonstrating the longterm deleterious health impacts of exposure to war-related traumatic events (1–3). Mental health outcomes, such as those associated with post-traumatic stress disorder (PTSD) and depression, have received particularly intense attention and are perhaps best documented (4–6). However, it is clear that war trauma associates with an extensive range of other adverse health outcomes and concerns that last throughout life, including such diverse domains as adverse health behaviors, functional health and disability, diagnosed chronic conditions, and general global assessments of wellbeing. These associations are either a function of the direct impact of the trauma experienced or effects mediated by other psychological causes such as PTSD (7–11).

Assessing the precise direct and indirect impacts and the possible interventions that may moderate their influences depends greatly on an ability to evaluate wartime experiences, which sometimes occurred earlier in life, quantify the degree of trauma that was encountered, and categorize these involvements in ways that allow us to understand the how different types of exposures impact upon the course of different domains of health. Since the mid-1980s, a variety of approaches and instruments have been advanced to measure wartime exposure and related war stressors (6, 12–14). Based on the diagnostic criteria for trauma, these measures tend to include items such as those that gauge threats and fear of

death, being seriously injured, experiencing sexual violence, witnessing such events or threats to others such as fellow combatants, and experiencing other harmful physical conditions.

The preponderance of studies that have constructed and analyzed such measures focus on American veterans or veterans in other developed western countries fighting wars that occurred far from their communities of origin. In contrast, the measures adopted to categorize and quantify wartime exposure have less frequently been assessed for use among populations living in places where wars actually ensue. Exposure to traumatic events within the latter groups is particularly salient in *guerilla* warfare situations or in contemporary civil conflicts that unfold within villages, neighborhoods, and on roadways within urban and rural developing country settings. In these settings, potentially traumatic exposures might extend to death and injuries occurring among friends, relatives, and neighbors, the experience of being evacuated from one's home due to fear of oncoming violence, and fears that accrue to civilians and paramilitary personal as well as military combatants.

The American-War fought in Vietnam presents an ideal context to develop and evaluate measures of wartime exposure for the purpose of examining the long-term impacts of war. Those who experienced wartime trauma during this period (1965–1975) today are moving into older ages where the incidence and prevalence of chronic conditions and other health problems are heightened. The conflict that they experienced was unusually brutal and was experienced by many different types of individuals, including military personnel, paramilitary, and civilian women and men. In Vietnam, exposure among non-military groups has rarely been identified, quantified, and categorized. Doing so requires access to retrospective data collected from cohorts of Vietnamese that lived through the war. This study uses a new and unique data source, the Vietnam Health and Aging Study (VHAS), with just such information. The VHAS surveyed 2,447 individuals living in several regions of northern and central Vietnam that were differentially exposed to the American War, inquiring about their wartime experiences. Using these items, we aim to develop and evaluate measures of wartime exposure that would be relevant for studying the subsequent impacts of the trauma associated with war and long-term health and other life-course outcomes among the former military, paramilitary, and civilian populations of Vietnam.

Defining Traumatic Events

Measuring the exposure to traumatic events that precede the experience of trauma and resultant mental and physical health issues requires a clear definition of "traumatic events." The American Psychiatric Association (APA) defines trauma as "an emotional response to a *terrible event* like an accident, rape or natural disaster" (15). The "terrible events" of import for this study are war-related traumatic events and stressors. Researchers have long struggled to understand the precise features of traumatic stressors (16–18). Weathers and Keane (18) note that crafting a definition of trauma and traumatic events is difficult, in part, due to the many relevant dimensions of stressors, including their "magnitude (which itself varies on several dimensions, e.g., life threat, threat of harm, interpersonal loss…), complexity, frequency, duration, predictability, and controllability" (18). As such, most researchers rely on descriptions of traumatic events contained in the diagnostic criteria for PTSD (6, 18, 19). The clinical definition and diagnostic, found in

the current version of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-V), lays out five criteria for diagnosing PTSD. The first criterion, without which there can be no diagnosis, is the exposure to an event that is universally acknowledged to be traumatic (18, 20, 21). Specifically, Criterion A requires: "[e]xposure to actual or threatened death, serious injury, or sexual violence," by directly experiencing or witnessing the traumatic events or learning about the traumatic experiences of family and close friends (20). In this paper, we follow previous scholars in relying on the description of traumatic stressors provided in the DSM-V, specifically being wounded, seriously injured, or almost killed; witnessing acts of injury and killing; and learning about the death and injury of family members. We supplement the events outlined in Criterion A with war-related stressors validated by previous scholars, including engaging in combat duties, exposure to malevolent conditions, and witnessing the effects of war violence. We also test new stressors for their potential relevance to the Vietnam context.

Existing Warzone Stress Scales

Two broad research domains have investigated war-related traumatic stressors and how to measure them. One domain focuses on war veterans, while the other centers on refugees.

Research into traumatic events experienced by veterans has identified stressors clustering in four dimensions: combat activities, nearness to death and severe injury, moral injury, and inhospitable conditions. For many veterans, especially those deployed to combat duties, some exposure to the death and serious injury, whether to one's self or others, is practically a foregone conclusion. As such, early scales measured exposure to war-related violence by cataloging combat experiences (6, 14, 22). However, scholars also recognized that war-related exposure to traumatic events extends beyond mere combat exposure. For example, scholars have also examined the relationship between trauma and the personal "moral injury" that can occur when one commits or witnesses the commission of atrocities (5, 21, 23, 24). For example, Laufer and his colleagues tested a model of war-related trauma that included three dimensions: combat experiences, witnessing abusive violence, and participation in abusive violence. This scale was innovative in that it accounted for the guerilla-style of warfare characteristic of the Vietnam War. Laufer's subjects reported stress related to their inability to "distinguish between noncombatants and the enemy," "sanctioned acts of brutality," and the use of "cruel weapons" (24).

Scholars have also documented the important role of malevolent living conditions for the experience of trauma (5, 14, 21). King et al. (21) found that among American veterans of the Vietnam War, exposure to a malevolent environment (i.e., the undesirable food, climate, living conditions, and other chronic, low-grade hassles of warzone deployment) was the most pronounced contributor to PTSD, far surpassing the influence of combat. However, for civilians and local military residents of warzones, the conditions constituting malevolent or inhospitable living environs likely differ from those enumerated by veterans of foreign wars, a theme investigated in research on trauma in refugees.

The second domain of trauma research focuses on sources of trauma for refugees, asylees, and displaced persons. This branch of research often omits combat-related inquiries in favor of war-related stressors that might be experienced by anyone, but it adds new dimensions of stressors, including mental

injury, extrajudicial operations, and displacement. In addition, this body of work adds breadth to dimensions of trauma investigated with veterans. For example, paralleling inquiries into combat activities, this domain of scholarship asked about exposure to shelling, bombing, or military attacks, as well as whether the respondent was involved in combat (25–27). Participation in combat, when asked, was asked of all respondents, regardless of whether they were officially associated with a military organization. However, this body of scholarship often neglects to ask whether the subjects were members of the formal military or paramilitary organizations. The injury and danger components of the combat dimensions are substantially broader in the refugee literature. Items are typically included that capture not only being injured or nearly killed, but also the experience of torture, assault, kidnapping, and mental injuries such as brainwashing and extortion (26, 28, 29). Most studies supplement these measures of combat and injury with assessments of potentially traumatic extrajudicial events and activities, such as detention, arrest, extrajudicial executions, household searches and occupation, and other "mopping up" operations designed to discover terrorists in civilian populations (27, 28, 30).

A notable omission in measurement scales designed for veterans is the lack of attention to evacuation and other "less than voluntary" migration experiences. This oversight likely stems from the fact that prior research focused primarily on American veterans of foreign wars. However, refugee scholarship informs us that war-related forced migration is concurrent with exposure to other traumatic events and dangers typically associated with warzones. Moreover, forced migration has been associated with subsequent mental distress (25, 31, 32) and may have both a direct and indirect connection to post-traumatic stress. To illustrate the complexity of the relationship between displacement as a traumatic event and mental health, Porter and Haslam (33) describe how refugees experience stress accumulating at multiple different stages of displacement, including preflight, flight, exile, and resettlement or repatriation. For example, the circumstances of preflight and flight exit that affect mental health include the amount of time available to prepare for departure, age at departure, family separation/unity, and resources for departure, among others. Conditions while in exile can also vary dramatically (e.g., duration, living structure, availability of food and water, family unity), affecting subsequent mental health (33, 34). Finally, conditions of return also play a key role. After surveying 1,100 households in Kosovo, Wang (2010) conducted follow-up interviews with a subset of respondents to investigate why displacement was so frequently listed as a source of trauma. They learned that "most people became traumatised after their return to Kosovo because they found their houses and property completely or partially destroyed… They often found that close relatives or friends had been killed or were missing" (27). Such conditions at each stage of displacement compounded the trauma of displacement itself.

Finally, refugee scholars detail a different set of inhospitable living conditions than those itemized in studies of trauma in veterans. This domain of research emphasizes deprivation and damage to property as the principal living conditions that are associated with trauma. Stressors include shortages of food and water, lack of access to medical care when ill or injured, and the economic and psychological stress of property damage and loss (26, 30).

This study seeks to integrate the insights of the two domains of research encapsulating traumatic events and evaluate the dimensions of stressful wartime events for their relevance as indicators of trauma in northern Vietnamese survivors of the American war. We look at the dimensions of combat activities, personal and family injury and death, witnessing death and severe injury, moral injury, inhospitable conditions, and displacement. Two recent studies noted that some scales clustering combat activities, injury, and nearness to death into distinct groups demonstrated poor divergent validity (12, 35). As such, we also explore the dimensionality of traumatic events, anticipating that the events may cluster differently than previously thought. We also test whether the dimensionality is consistent across civilians, informal military, and formal military respondents. Finally, the two principal research domains primarily (though not exclusively (36)) study people who no longer reside in the location where they were exposed to conflict, i.e., veterans of foreign wars and refugees resettled outside the warzone. Our study seeks to integrate the two conceptual domains and fill a critical gap in the research (37), investigating the nature of warzone stressors for residents of Vietnam, subgroups of whom include civilians, veterans of the formal military, and paramilitaries and others peripherally involved in war efforts.

Method

Data and Sample

This paper analyzes data from the Vietnam Health and Aging Study (VHAS), collected in face-to-face interviews conducted in 2018. VHAS was designed to investigate the longterm effects of exposure to war, specifically, the American War, on older adult physical and mental health, overall wellbeing, and mortality. VHAS used a multistage, stratified probability design to sample 2,447 men and women aged 60 and older in four districts of northern and central Vietnam. This age group was chosen because it encountered the height of the American War (1965–1975) during their early adulthood. The four districts were purposively-selected to represent a spectrum of war exposure, as indicated by the intensity of bombings during the war years (38, 39). Men and women with both formal and informal military service were included in the sample, as were nonveterans. Service in informal military organizations, such as the Youth Shock Brigades (TNXP) and community militia groups, provided logistical and other support for formal military groups. The TNXP, or youth volunteer force, was comprised of young volunteers, including young women, who provided various forms of support to the war effort, from provision of weapons and foodstuffs to infrastructure repair and bomb disposal (40). In many ways, their exposure to dangerous and traumatic events paralleled that of the formal military. However, they were also significantly less likely to exchange fire with the enemy. Our approach compares exposures across these three groups that encountered an assortment of different wartime conditions and experiences.

Measures

The measures included in our study derive from questions about respondents' military participation, death and disability among family members, diverse forms of war exposure, and PTSD.

Group Variable—Military Participation.

Concerning military participation, the survey asked: "Have you ever participated in any military activities?" Response options included: *served in the formal military (Viet Minh, before 1954)*, *served in the formal military (People's Army of North Vietnam)*, *served in the formal military (Army of the Republic of Vietnam)*, and *served in the Youth Shock Brigade (Thanh niên xung phong or TNXP)*, and *involved in other militia services*. We grouped both types of formal military service into a formal military category and combined service in the TNXP and militia into an informal military category.

Death and Disability of Family Members

Reflecting the conceptual and operational definitions of traumatic stressors described above, we included items assessing deaths among family members due to the war and severe injury and disability of family members as a result of the war (14). Familial experiences of war-related death and disability were assessed separately for the respondent's father, mother, brother(s), sister(s), spouse, and children.

War Exposure Variables

The VHAS survey contained question sets assessing four types of trauma exposure referenced in prior studies: nearness to death and severe injury, malevolent conditions, combat experiences. Nearness to death items included questions about seeing dead or seriously injured Vietnamese soldiers, foreign soldiers, and civilians; and questions about being injured and knowing people injured or killed in battle. Items gauging exposure to malevolent conditions included questions documenting displacement due to village bombings or evacuations, as well as questions regarding shortages of clean water and food, inability to sleep due to noise or inhospitable conditions, fearing being injured or killed, and exposure to toxic chemicals, including agent orange.

The combat experience questions—asked only of respondents with formal or informal military experience —inquired about eight combat experiences. These questions assessed how many times the respondent experienced going on patrols, being ambushed, coming under artillery fire, firing at the enemy, being responsible for the death of the enemy, being nearly shot, and having friends shot near them in battle.

PTSD Variables

The VHAS includes nine questions, drawn from the 20-item PTSD Checklist, version 5 (PCL-5), assessing respondents' experience of PTSD. The survey only included nine questions, in part, to reduce the burden on the respondent. In addition, VHAS investigators removed questions because they did not translate well, either linguistically or culturally, to the Vietnam context, or were politically sensitive. Reduced scales, some with as few as two items, have been previously validated by scholars seeking to apply the scale internationally (41–43). The nine questions included in the survey asked whether the respondent had experienced a specified form of stress and how much it bothered them. Questions tapped the respondents' level of re-experiencing traumatic events, avoiding reminders, emotional numbing, arousal, and anxiety.

Data Analysis

The purpose of this study was to establish a measure of stressful war experiences that is valid for veterans of both formal and informal military organizations, as well as civilians in Vietnam. Because the survey combined items from scales previously used solely with veterans assessing both combat and noncombat experiences, with items designed to assess trauma exposure in civilians, it was necessary to evaluate how these questions hang together as indicators of stressful war experiences. To that end, we conducted exploratory factor analysis (EFA), comparing the results across civilians, informal military, and formal military, followed by confirmatory factor analysis (CFA). To account for the fact that some items were binary while others contained multiple categories, we recoded all items into binary indicators to reduce bias stemming from method effects (44, 45). To account for the fact that some questions were not asked of civilians, we tested separate models for civilians, informal military, and formal military.

The unique VHAS sampling approach required that we use survey estimation methods and apply sampling weights to our models. However, many statistical operations limit the application of survey-estimation techniques and sampling weights. In addition, binary variables require special treatment in factor-analytic models, specifically, analysis based on tetrachoric correlations. Thus, our analysis proceeded in four broad steps: 1) preliminary inspection of the tetrachoric correlation matrix, 2) estimation of weighted tetrachoric EFA using the iterated principal factors (IPF) method with oblique rotation, 3) conduct of survey-adjusted CFA with sampling weights. All analyses were conducted in Stata version 15.

We undertook step one, the inspection of the item correlations, following the recommendations of DeVellis (50), who argues that scale items must be highly intercorrelated. Tetrachoric correlations were used to compensate for the artificially-binary structure of our scale items (51). We engaged in multiple iterations of weighted tetrachoric EFA, step two, to assess item clustering and make a preliminary determination regarding the appropriate number of factors via eigenvalues, scree tests, and parallel analysis. When clear factor structures were not apparent, we compared alternate model specifications, preferring those models with the cleanest factor loadings (i.e., strong loadings, no cross-loadings, and multiple items per factor). Table 1 details our retention criteria. Finally, we used survey adjusted, weighted CFA to refine and confirm the relational structure of the factors (e.g., relationship between factors, subdimensions, etc.) and to evaluate the theoretically-relevant correlations between item error terms.

To assess model fit, we evaluated the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, root mean squared error of approximation (RMSEA), standardized root mean squared residual (SRMR), and comparative fit index (CFI). Our goodness of fit (GOF) criteria are shown in Table 2. To confirm the appropriateness of scales derived from our factor analysis, we evaluated their reliability and validity using coefficient omega, composite factor reliability (CR), average variance extracted (AVE), squared correlations between factors (SC), and the correlation of factors with PTSD. The purpose of each measure and the criteria for establishing reliability or validity are shown in Table 2.

Table 1
Factor Retention and Composition Criteria

	Step	Purpose	Criteria
Factor (F) Retention			
Eigenvalue	2	Variance explained by F	≥ 1.0
Scree Test	2	F Strength/relevance	Elbow location (52)
Parallel Test	2	F Strength/relevance	Line intersection
Factor Correlation	2−3	F Distinctiveness	< 0.85 (44,53)
Factor Composition			
Correlation	1	Sufficient association	≥ 0.3 (50)
Loadings	2−3	Item determinacy	≥ 0.4 (50)
Crossloading	2−3	Item distinctiveness	Diff. > 0.5 (46,50,51)
# Items per factor	2−3	Model identification	> 2 (44,50,51)
Uniqueness	2−3	Proportion unexplained by F	≤ 0.6 (44,50)

Table 2
Goodness of Fit Criteria

	Step	Purpose	Criteria
GOF			
KMO	2	Sampling adequacy	≥ 0.7
RMSEA	3	General fit – model parsimony	≤ 0.08 (44,56)
SRMR	3	Diff. between sample & model	≤ 0.08 (57)
CFI	3	General fit – Comparative fit	≥ 0.95 (56,57)
Appropriateness			
Reliability			
Omega	3	Internal reliability	≥ 0.7 (55)
CR	3	Composite reliability	(58)
Validity			
AVE	3	Convergent validity	≥ 0.5 or > CR (59,60)
SC	3	Discriminant validity	AVE > SC (58)
Corr. with PTSD	3	Concept validity	p ≤ 0.05

Results

The analytical sample for this study included 1,195 men and 1,252 women. In all, 43% of the respondents engaged in military activities during the war, with 56% of men and 34% of women reporting military activities. Nineteen percent of the respondents were members of the formal military, while 24% participated in informal military activities such as the militia or TNXP. Most respondents reported that they did not have family members who were casualties of the American war, nor did they have family members who were disabled due to the war (see Table 3). However, 69% of respondents experienced at least one war-specific stressor exposure. With regard to wartime experiences and living conditions, 52% of all respondents reported that they had no experience witnessing death and severe injury, while 25% reported that they had at least one of these experiences more than ten times. Similarly, 40% of all respondents did not report experiencing malevolent living conditions, while 42% experienced more than one type of malevolent living condition. Men, women, veterans, and nonveterans reported minimal differences in their experiences of malevolent conditions. Finally, among those with military service, a notable 50% reported no exposure to stressful combat experiences. However, 55% did not serve in the

formal military, and thus may have served in support rather than combat positions. (Table 3 summarizes stressor exposures).

The weighted tetrachoric correlation matrix showed strong correlations between all items in the expected groups. For example, items reflecting the experiences of seeing dead and severely injured people and, for veterans, all combat specific items correlated above 0.3. Several of these items also correlated with shortages of clean water, exposure to toxic chemicals, and experiencing fear of death, indicating potential cross-loading items, requiring clarification via factor analysis. Inhospitable living conditions and war-related migrations also demonstrated the expected correlations plus potential cross-loading correlations. When computed separately for civilians, informal military, and formal military, the correlation matrices showed that the patterns of correlations varied between the three groups, potentially warranting separate analyses. We examined these patterns further using weighted tetrachoric EFA with oblique rotation followed by weighted CFA.

Table 3
Descriptive Statistics (percent reporting having had the experience at least once)[a]

	All Rs	Civilians (C)	Informal Mil (I)	Formal Mil (F)	Significant Differences between Groups
Family Death/Disability	51.4	51.1	56.6	45.9	I vs. F
Death of family member	32.5	33.7	34.8	26.1	
Disability of family member	27.6	22.1	33.6	27.4	
Witness Death/Severe Injury	48.5	35.6	52.4	**80.8**	C vs. F; I vs. F
Saw dead Vietnamese soldiers	35.2	**19.2**	**40.0**	**75.6**	C vs. I; C vs. F; I vs. F
Saw dead foreign soldiers	16.0	**5.8**	**16.3**	**44.9**	C vs. I; C vs. F; I vs. F
Saw dead civilians	40.7	31.6	47.2	**58.8**	C vs. F; I vs. F
Wounded in warzone	11.1	**1.9**	**9.7**	**39.3**	C vs. I; C vs. F; I vs. F
Know injured people	31.8	**20.7**	**39.5**	**54.8**	C vs. I; C vs. F; I vs. F
Malevolent Conditions	59.7	**51.6**	66.0	75.7	C vs. I; C vs. F
Moved due to bombings	22.8	20.5	27.6	23.6	
Moved due to evacuation	21.3	20.1	22.8	23.1	
Shortage of clean water	11.5	7.5	12.3	**22.3**	C vs. F; I vs. F
Food shortage	20.4	17.6	22.0	26.7	
Inability to sleep	36.4	30.3	41.9	47.2	C vs. F
Fear being injured or killed	32.4	30.3	38.9	30.7	
Exposure to toxic chemicals	7.5	**2.2**	**5.2**	**25.5**	C vs. I; C vs. F; I vs. F

[a]Weighted percentages shown.

[b]Significance tested via binary logistic regression (survey adjusted, with sampling weights) with marginal predictions and confidence intervals using a significance level of 0.05. Bold indicates a group is significantly different from all other groups.

[c]These questions were only asked of people who participated in military activities. Proportions for informal and formal military are based on veterans only.

	All Rs	Civilians (C)	Informal Mil (I)	Formal Mil (F)	Significant Differences between Groups
Combat Experiences[c]	21.6	—	**31.0**	**73.5**	I vs. F
Went on military patrols	17.0	—	**21.2**	**63.2**	I vs. F
Was ambushed	11.1	—	**8.6**	**47.7**	I vs. F
Came under artillery fire	12.3	—	**10.9**	**51.1**	I vs. F
Shot at the enemy	10.5	—	**4.9**	**49.2**	I vs. F
Caused death of enemy	6.5	—	**1.8**	**32.0**	I vs. F
Was nearly shot	9.4	—	**10.6**	**36.6**	I vs. F
A friend was shot	11.0	—	**8.8**	**46.9**	I vs. F

[a]Weighted percentages shown.

[b]Significance tested via binary logistic regression (survey adjusted, with sampling weights) with marginal predictions and confidence intervals using a significance level of 0.05. Bold indicates a group is significantly different from all other groups.

[c]These questions were only asked of people who participated in military activities. Proportions for informal and formal military are based on veterans only.

In preliminary tests using EFA models, we discovered that although experiencing the death or disability of family members clustered strongly into two respective factors, the factors were largely unrelated to other stressful war experiences. Based on this result, and the fact that the death and disability of family members items are conceptually and chronologically distinct from the other major war-related stressors (i.e., they can occur outside the context of war; may have occurred when the respondent was quite young and could not recall; or may have occurred during earlier wars for which we lack other war stressor measures), we removed these items from all models.

Our first set of models, analyzing civilian respondents, yielded three factors: exposure to war violence (VIOL), inhospitable conditions (COND), and war-related migration (MOVE). In EFA, the eigenvalues and the scree test indicated two factors. However, the two-factor model had cross-loading items indicating either that more factors were needed or that the cross-loading items were not relevant to the factors. We tested models with 1, 2, 3, and 4 factors. The 3-factor model was the only model to meet all factor composition criteria. It also made the most sense theoretically and was confirmed in CFA, with one substantive difference—the COND and MOVE factors were shown to function as sub-dimensions of a broader wartime environment (ENV) factor. Figure 1 shows the relational structure of these factors.

Figure 1. Factor Structure of War-related Traumatic Events for Civilians

The war violence factor included seeing dead or seriously injured Vietnamese and foreign soldiers, seeing dead or seriously injured civilians, and being wounded in the warzone. *Knowing people who were injured* was removed from the factor during CFA due to its high unique variance. This factor captures experiences related to being the victim of violence, witnessing violence, or witnessing the effects of violence. The inhospitable conditions factor included experiencing shortages of food and clean water, and the inability to sleep due to noise and other inhospitable conditions. The migration factor included three items: *moving due to bombings* and/or *evacuations*, and *exposure to toxic chemicals*. The wartime environment factor encompasses both displacement and inhospitable living conditions confirming the close relationship between these two sets of items. Table 4 presents factor loadings.

Table 4
Factor Loadings for All Models

	Civilians		Informal Mil.		Formal Mil.	
Wounded in warzone	VIOL	0.620	COMBAT	0.617	COMBAT	0.673
Know people who were injured						0.614
Saw dead Vietnamese soldiers		0.991				0.911
Saw dead foreign soldiers		0.823		0.560		0.737
Saw dead civilians		0.816				
Went on combat patrols		—		0.636		0.828
Was attacked/ambushed		—		0.769		0.829
Came under artillery fire		—		0.824		0.889
Shot at the enemy		—				0.898
Caused death of an enemy		—				0.842
Was nearly shot		—		0.828		0.693
Friend was shot near R		—		0.726		0.830
Exposed to toxic chemicals	MOVE	0.549				
Moved due to bombings		0.792	COND	0.948		
Moved due to evacuation		0.642		0.947		
Shortage of clean water	COND	0.962		0.615	COND	0.836
Food shortage		0.866		0.552		0.926
Inability to sleep		0.469				0.563
Fear of death/severe injury		0.481				
COND	ENV	0.848		—		—
MOVE		0.797		—		—
N				598		942

The civilian model demonstrated acceptable goodness of fit (KMO = 0.77; RMSEA = 0.05; CFI = .95), and all factors demonstrated acceptable internal reliability (omega ≥ 0.7). All factors also exhibited convergent validity with AVE values greater than 0.5 and discriminant validity. See Table 5 for reliability and validity statistics. In addition, correlations between predicted factors and PTSD indicate that the

factors are indeed associated with the theoretically related phenomenon, PTSD, demonstrating concept validity.

Table 5
Model Evaluation Statistics — Civilians

	Criteria	VIOL	COND	MOVE	ENV
Reliability					
Omega	≥ 0.7	0.89	0.80	0.70	0.87
CR		0.58	0.61	0.60	0.47
Validity					
AVE	≥ 0.5 or > CR	0.68	0.53	0.56	0.50
SC	AVE > SC	0.31; 0.35	0.31; 0.26	0.35; 0.26	0.12
Corr. w/ PTSD	$p \leq 0.05$	0.31*	0.32*	0.18*	0.31*

The second set of models, analyzing informal military respondents, yielded two factors: exposure to combat conditions and related violence (COMBAT) and inhospitable conditions and displacement (COND). In EFA, the eigenvalues and the scree test indicated two factors. However, the two-factor model had cross-loading items indicating either that more factors were needed or that the cross-loading items were not relevant to the factors. We compared models with 1, 2, 3, and 4 factors. None of the models improved the factor composition statistics. Moreover, the 2-factor model made the most sense theoretically. We revised the 2-factor model, removing *Know people who were injured* due to low loadings and high uniqueness, and removing *Saw dead Vietnamese soldiers* and *Saw dead civilians due* to cross-loading with nearly equivalent values on both factors. At this stage, we retained *Fear of death/severe injury* despite high uniqueness because it had adequate factor loadings, and there are strong theoretical reasons for retaining it. In CFA, we found extremely low factor loadings and high unique variances for *Exposed to toxic chemicals* and *Fear of death/severe injury*. When retaining these items, model fit statistics were poor, and removal of the items improved RMSEA, SRMR, and CFI, raising them to acceptable levels. However, the convergent validity of the COMBAT was below acceptable levels (AVE = 0.47). Removal of two additional items (*Shot at the enemy* and *Caused death of an enemy*) exhibiting low equation-level r-squared values improved convergent validity and further improved the model's goodness of fit statistics. Figure 2 shows the final structure of these factors for respondents with an informal military background.

Figure 2. Factor Structure of War-related Traumatic Events for Participants in Informal Military Activities

The combat factor included being wounded in the warzone, going on combat patrols, being ambushed, coming under artillery fire, shooting at the enemy, nearly being shot, and having a friend shot near them in

battle. This factor primarily captures experiences related to engaging in the formal activities of war. The inhospitable conditions factor included *moving due to bombing* or *evacuation* and experiencing *food shortages*. Exposure to toxic chemicals, shortages of clean water, and the inability to sleep failed to load on the factor in CFA. See Table 4 for factor loadings.

The informal military model demonstrated acceptable goodness of fit (KMO = 0.78; RMSEA = 0.03; CFI = .99), and all factors demonstrated acceptable internal reliability (omega ≥ 0.87). All factors also exhibited convergent validity with AVE values greater than 0.5 and discriminant validity. See Table 6 for reliability and validity statistics. In addition, correlations indicate that the predicted factors were again associated with PTSD, exhibiting concept validity.

Table 6
Model Evaluation Statistics — Informal Military Model

	Criteria	COMBAT	COND
Reliability			
Omega	≥ 0.7	0.88	0.86
CR		0.50	0.67
Validity			
AVE	≥ 0.5 or > CR	0.51	0.62
SC	AVE > SC	0.09	0.09
Corr. w/ PTSD	p ≤ 0.05	0.33*	0.32*

Our final set of models, analyzing formal military respondents, also yielded two factors: exposure to combat conditions and related violence (COMBAT) and inhospitable conditions (COND). In EFA, the eigenvalues and the scree test indicated three factors. The 3-factor model had one item (*Moved due to bombings*) with a negative uniqueness value, indicating that this solution was a Heywood Case. Factor 3 contained only two items making it "just" identified, thus the possible source of the Heywood solution (Chen 2001). We tested alternate 1- and 2-factor solutions. The 1-factor model exhibited high uniquenesses on all items related to moving and inhospitable conditions, making it a less appropriate solution. In the 2-factor model, *Fear of death/severe injury* failed to load on either factor; it was removed from the final EFA model. While *Exposed to toxic chemicals* had a somewhat low loading on Factor 1 (0.36) and very high uniqueness (0.81), we retained it at this stage because it is theoretically relevant. In CFA models, *Moved due to bombings* exhibited problematic uniqueness levels, and when removed, *Moved due to evacuation* had a very high unique variance (0.90). *Saw dead civilians* and *Exposed to toxic chemicals* also demonstrated high unique variances (above 0.80). Removing the four problematic items improved all goodness of fit statistics. Figure 3 shows the relational structure of these factors.

Figure 3. Factor Structure of War-related Traumatic Events for Veterans of the Formal Military.

The COMBAT factor included a mix of variables related to being the victim of violence, witnessing violence and its effects, and engaging in combat activities. The inhospitable conditions factor included experiencing shortages of food and clean water, and the inability to sleep due to noise and other inhospitable conditions. However, the factor failed to include war-related displacement. See Table 4 for factor loadings.

The formal military model demonstrated acceptable goodness of fit (KMO = 0.92; RMSEA = 0.04; CFI = .98), and all factors demonstrated acceptable internal reliability (omega ≥ 0.83). All factors also exhibited convergent validity with AVE values greater than 0.5 and discriminant validity with factor convergence greater than the squared correlation between factors. Table 7 shows the model's reliability and validity statistics. Finally, correlations between predicted factors and PTSD indicate that the factors are again associated with PTSD, demonstrating concept validity. In the next section, we discuss the implications of the various factor structures below.

Table 7
Model Evaluation Statistics — Formal Military

	Criteria	COMBAT	COND
Reliability			
Omega	≥ 0.7	0.94	0.86
CR		0.63	0.60
Validity			
AVE	≥ 0.5 or > CR	0.64	0.63
SC	AVE > SC	0.13	0.13
Corr. w/ PTSD	$p \leq 0.05$	0.36*	0.29*

Discussion

The goal of this study was to develop measures of war-related stress exposure for use with older Vietnamese men and women who lived through the American war and currently reside in Northern or North Central Vietnam. Our intent was to develop a measure of war-related stress exposures that were valid in the Vietnam context and would allow future researchers to investigate the longterm effects of said war-exposure for civilians, formal military, and paramilitary alike. In pursuing this goal, we integrated the insights of two scholarly domains: trauma research focusing on veterans and that focusing on refugees. As a result, our study yields novel information on the content of war-related stress for survivors

of war in diverse post-conflict contexts outside of the widely studied U.S. veteran population. Four key findings are important to highlight: 1) Some common predictors of PTSD, while they may occur during wartime, are not components of war-related trauma exposure; 2) Items from prior instruments did not operate as distinct factors or subscales, rather they clustered with items from other instruments; 3) The contributions of both domains of trauma research—veterans studies and refugee studies—are relevant for studying trauma in residents of warzones; and finally, 4) Civilians, members of militias and other less formalized military organizations, and members of formal military organizations, experience war events differently, indicating the need for distinct measurement approaches.

War trauma versus general trauma

One common predictor of PTSD, witnessing or learning of the violent or accidental death or severe injury of a family member(s), is a likely occurrence among those who live in warzones. Prior research has shown a strong correlation between these experiences and PTSD or other forms of mental distress (62, 63). Moreover, these events are described in the DSM-V as part of the definition and description of traumatic event exposure contained in Criterion A. Our study found that while the death and disability of family members may contribute to PTSD, this form of exposure is distinct from war-related trauma exposure and should not be included in scales designed to measure war-related trauma exposure. Consequently, researchers should not ignore this predictor of PTSD, especially in contexts within which the violence of armed conflict results in loss of life beyond those engaged in the military, but they should treat it as a more general type of trauma exposure, distinct from war-related traumatic events.

Prior instruments and the VHAS population

The VHAS instrument adapted questions from the National Vietnam Veterans Readjustment Study (NVVRS) (14), Deployment Risk and Resilience Inventory (DRRI) (13), Combat Exposure Scale (CES) (6), and the PCL-5, while also including questions about injury to oneself, the death and injury of family members, and displacement. This unique composition of items allowed us to identify new factor structures for exposure to traumatic events and conditions in contexts of armed conflict. We found that for this sample, items from previously separate instruments clustered together, but the precise configurations varied across the civilian, formal military, and paramilitary populations. For example, items from separate factors or subscales within both the NVVRS and the DRRI, specifically, injury to oneself and exposure to dead or severely injured foreign soldiers, Vietnamese soldiers, and civilians, clustered together for civilian respondents, and a similar set of items clustered with CES items for both formal and informal military respondents. The restructuring of item clusters from prior scales indicates the need for scholars to draw items from a variety of sources and test factor structures for each new study context.

Integrating trauma research domains

This study integrated items previously used in two distinct trauma research domains. From studies of trauma in veterans, we incorporated nearness to death and combat exposure. From refugee studies, we included inhospitable conditions and displacement. While prior trauma research with veterans included

malevolent conditions, they used conditions perceived to be inhospitable to veterans of foreign wars, such as undesirable food, climate, living conditions, and other chronic, low-grade hassles of deployment. These conditions are unlikely to be perceived as inhospitable to populations residing in armed conflict locales. Thus, we drew from refugee studies, incorporating such inhospitable conditions as shortages of food and water, the inability to sleep due to bombings and conflict, and exposure to toxic chemicals. We found strong support for inclusion of these items as potentially traumatic events. We also found support for the inclusion of displacement items, commonly incorporated in refugee studies, for both civilians and members of the informal military. For civilians, displacement clustered with exposure to toxic chemicals, functioning as a subscale within inhospitable environmental conditions, while for the informal military, displacement and inhospitable conditions clustered together in a single factor. Regrettably, the VHAS did not contain items related to experiences of torture, assault, kidnapping, mental injuries, or extrajudicial activities, leaving us unable to test those items for relevance to measuring war-related traumatic events. Despite the absence of these items, this study was able to integrate some of the insights from both domains of research, indicating the need for researchers to craft interdisciplinary instruments that draw from both veterans and refugee studies, especially when studying mixed populations (e.g., civilians, formal military, and paramilitary).

Distinct approaches for separate subpopulations

A central finding of this study is that the items capturing exposure to war-related traumatic events differ for civilians, formal military, and paramilitary. This is especially important because prior research has not investigated paramilitary groups, such as militias or youth military organizations, as distinct subpopulations uniquely exposed to war events with unique experiences framing their perception of those events. Our analyses found distinct configurations of traumatic events relevant for each of the three groups.

In interpreting the factor composition for each of these groups, contextual knowledge is critical. For the civilians in the VHAS sample, nearly all of the items relevant to any of the groups (except combat items, which were not asked) were relevant to measuring their trauma exposure, indicating that all war-related exposures were potential trauma-exposures for those who were not trained members of military bodies. Only knowing people who were injured was not relevant to civilians. This is best understood in comparison to members of the formal military. Civilians who knew injured people were less likely to be traumatized since their acquaintance(s) survived. In contrast, for the formal military, injured acquaintances were likely their fellow soldiers. As such, the members of the military may have experienced something akin to survivor's guilt or a form of moral injury for failing to prevent the injury of their acquaintance.

Participants in informal military organizations exhibited the most 'erratic' configuration of combat/violence items. Though most of the experiences related to military activities and combat duties were relevant for members of paramilitary organizations, several of the more universally experienced violence-related exposures (i.e., events also experienced by civilians), such as being wounded in the

warzone and seeing dead or severely injured foreign soldiers were not. The irrelevance of these events for participants in informal military activities may reflect their more limited exposure to combat. As providers of logistical support to the formal military, these respondents were certainly exposed to attacks but were less likely to engage the enemy, thus less likely to be wounded or to see wounded or deceased foreign soldiers. The reduced propensity for exposure to the violent results of engagement with the enemy may increase the salience of these events as indicators of war-related trauma exposure. In contrast, for the formal military, nearly all exposures to both the effects of violence and combat activities are relevant to measuring exposure to war-related traumatic events.

Finally, while all inhospitable environmental conditions are relevant for measuring traumatic event exposure in civilians, albeit clustered in two subfactors, only displacement and shortages of food and water were relevant for participants in the informal military. Their training, duties, and their possible knowledge of military activities in the village may have negated the relevance of chemical exposure and sleep disturbances for cataloging traumatic-event exposure in members of military and paramilitary groups. For members of the military, inhospitable conditions were not traumatic experiences. The irrelevance of displacement for this group is not unexpected, as they were unlikely to be evacuated but highly likely to be deployed. Also, experiencing a fear of death or severe injury was irrelevant for both the formal and informal military, likely reflecting their repeated exposure as a part of their military duties. We suspect that for these groups, fearing death was a consequence of their duties, especially their combat duties. Thus, combat experiences more accurately reflect their nuanced exposure to the traumatic events of war. Further research should investigate civilian, informal military, and formal military perceptions of their experiences to distinguish how and why the relevant wartime stressors diverge for these groups. Ultimately, the distinct configurations of war exposure factors for these subpopulations speak to the need to recognize and individually analyze subpopulations' unique exposures to traumatic events. Specifically, in populations residing in warzones, it is crucial to understand the shades of informal military and their roles in the conflict.

One weakness of the current study is the amalgamation of the militias and the TNXP. It is possible that these groups had distinct experiences warranting distinct measurement tools. Unfortunately for this study, the sample sizes in these subgroups were too small to have adequate statistical power.

A second weakness of the current study relates to gender representation across military service subpopulations. In assessing exposure to war-related traumas, it may be important to consider gender as it structures the nature of exposure as well as the consequences of exposure (Self-identifying reference). Although the Vietnamese were heavily mobilized to join the Vietnam War effort, in the VHAS sample, women were still far less likely to be veterans than men. To compensate for gender imbalances in service, the VHAS study oversampled women with military service (38). However, female veterans were less frequently exposed to stressful military experiences than male veterans. This difference in exposure rates likely results from women fulfilling different military roles than men, such as women's higher prevalence in the Youth Shock Brigades as compared to the North Vietnamese Army. Future studies might further oversample women in a variety of military positions to investigate the intersection of gender and military

service and disentangle their distinctive influence upon relevant wartime stressors and the association of wartime stressors with PTSD and other health outcomes.

Conclusion

This study examined the wartime stress exposure of civilians, veterans of the formal military, and participants in informal military to develop a valid scale for use among diverse populations in low-income post-conflict countries, such as Vietnam. We validated two factors for each of these populations; however, the composition of these factors varied substantially across the groups.

For analysts seeking to understand the population-wide consequences of war-related trauma exposure, it is essential to incorporate existing war trauma measures, drawing from multiple disciplines, and to develop new measures that are specific to the social and historical characteristics of the conflict under examination. For example, malevolent conditions, in particular, will diverge across different countries, historical eras, and stages of economic development. Additionally, scholars should consider the war tactics used in the conflicts under examination. In a study of the war in Afghanistan, where guerilla warfare tactics have also been used, many previously used questions would be relevant, but new questions might be added to address exposure to improvised explosive devices and other contemporary war tactics (64). Specific questions related to novel forms of moral injury should also be considered. For example, in the Afghan situation, Taliban fighters regularly use civilians as human shields and disguise themselves as civilians (ibid.). Opposing military forces may repeatedly witness the death of civilians, triggering moral injury.

Finally, while the present study found support for items used in prior instruments, we also found support for new items drawn from other disciplines and items specific to the Vietnam context. We recommend that scholars seeking to measure war-related trauma include items specific to the conflict under study, inclusive of exposure to death and severe injury, combat experiences, forced migration, and malevolent conditions, and with particular attention to subgroups for whom these traumatic exposures might function differently, as they have for the subgroups in our study. This study has contributed to our understanding of diverse wartime experiences, improving our understanding of war-related trauma in the Vietnam context, offering insights for other contexts. Gender, military service, and other social statuses structure exposure to war trauma and reactions to that exposure. Understanding the experiences of distinct subpopulations improves our ability to discern the nature of trauma exposure and craft interventions that address the health and wellbeing of all members of the population.

Abbreviations

APA: American Psychiatric Association; AVE: Average variance extracted; CES: Combat Exposure Scale; CFA: Confirmatory factor analysis; CFI: Comparative fit index; CR: Composite factor reliability; DRRI: Deployment Risk and Resilience Inventory; DSM-V: Diagnostic and Statistical Manual of Mental Disorders – 5th Edition; EFA: Exploratory factor analysis; IPF: Iterated principal factors; GOF: Goodness of fit; KMO:

Kaiser-Meyer-Okin; NVVRS: National Vietnam Veterans Readjustment Study; PCL-5: PTSD Checklist, version 5; PTSD: Postraumatic stress disorder; RMSEA: Root mean squared error of approximation; SC: Squared correlations between factors; SRMR: Standardized root mean squared residual; TNXP: Thanh niên xung phong (Youth Shock Brigades); VHAS: Vietnam Health and Aging Study

Declarations

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Availability of data and materials

The dataset used in the current study are available from the authors upon reasonable request and with completion of data user agreement.

Ethics approval and consent to participate

Ethics approval for the current study was obtained from the University of Utah's Institutional Review Board (IRB_00099861), Mount Saint Vincent University's Research Ethics Board (2018–047), Hanoi Medical University's

Independent Review Board in Bio-medical Research (IRB No. 00003121) and Vietnam's Ministry of Health.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Authors' contributions

YY and KK conceptualized the study. YY conducted all analyses and drafted the initial manuscript. ZZ conducted duplicate analyses and provided feedback on interpretation of data. TKT made critical contributions to the framing and interpretation of the study. All authors contributed to critically reviewing multiple drafts of the manuscript. All authors read and approved the final manuscript.

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References

1. Bedard K, Deschênes O. The Long-Term Impact of Military Service on Health: Evidence from World War II and Korean War Veterans. Am Econ Rev. 2006;96(1):176–94.

2. Levy BS, Sidel VW. War and Public Health. Oxford University Press, USA; 2008. 412 p.

3. Spiro A, Settersten RA. Long-Term Implications of Military Service for Later-Life Health and Well-Being. Res Hum Dev. 2012;9(3):183–90.

4. de Jong JTVM. Lifetime Events and Posttraumatic Stress Disorder in 4 Postconflict Settings. JAMA. 2001;286(5):555.

5. Fontana A, Rosenheck R. Model of War Zone Stressors and Posttraumatic Stress Disorder. J Trauma Stress. 1999;12(1):111–26.

6. Keane TM, Fairbank JA, Caddell JM, Zimmering RT, Taylor KL, Mora CA. Clinical Evaluation of a Measure to Assess Combat Exposure. Psychol Assess J Consult Clin Psychol. 1989;1(1):53–5.

7. Durai UNB, Chopra MP, Coakley E, Llorente MD, Kirchner JE, Cook JM, et al. Exposure to Trauma and Posttraumatic Stress Disorder Symptoms in Older Veterans Attending Primary Care: Comorbid Conditions and Self-Rated Health Status. J Am Geriatr Soc. 2011;59(6):1087–92.

8. Gallers J, Foy DW, Donahoe CP, Goldfarb J. Post-traumatic stress disorder in Vietnam combat veterans: Effects of traumatic violence exposure and military adjustment. J Trauma Stress. 1988;1(2):181–92.

9. Johnson AM, Rose KM, Elder Jr. GH, Chambless LE, Kaufman JS, Heiss G. Military Combat and Risk of Coronary Heart Disease and Ischemic Stroke in Aging Men: The Atherosclerosis Risk in Communities (ARIC) Study. Ann Epidemiol. 2010;20(2):143–50.

10. Nichter B, Norman S, Haller M, Pietrzak R. Physical health burden of PTSD, depression, and their comorbidity in the U.S. veteran population. J Psychosom Res. 2019;124(109744):1–7.

11. O'Toole BI, Catts SV. Trauma, PTSD, and physical health: An epidemiological study of Australian Vietnam veterans. J Psychosom Res. 2008;64:33–40.

12. Kimbrel NA, Evans LD, Patel AB, Wilson LC, Meyer EC, Gulliver SB, et al. The critical warzone experiences (CWE) scale - Initial psychometric properties and association with PTSD, anxiety, and depression. Psychiatry Res. 2014;220(3):1118–24.

13. King LA, King DW, Vogt DS, Knight J, Samper RE. Deployment Risk and Resilience Inventory: A Collection of Measures for Studying Deployment-Related Experiences of Military Personnel and Veterans. Mil Psychol. 2006;18(2):89–120.

14. Kulka RA, Schlenger WE, Fairbank JA, Hough RL, Jordan BK, Marmar CR, et al. Contractual Report of Findings from the National Vietnam Veterans Readjustment Study. Research Triangle Park, NC: Research Triangle Institute; 1988 p. 1–682.

15. American Psychiatric Association. Trauma. American Psychiatric Association. 2019. Available from: https://www.apa.org/topics/trauma/

16. Green BL. Defining Trauma: Terminology and Generic Stressor Dimensions1. J Appl Soc Psychol. 1990;20(20):1632–42.

17. Keane TM. Defining traumatic stress: Some comments on the current terminological confusion. Behav Ther. 1985;16(4):419–23.

18. Weathers FW, Keane TM. The criterion a problem revisited: Controversies and challenges in defining and measuring psychological trauma. J Trauma Stress. 2007;20(2):107–21.

19. Charak R, Armour C, Elklit A, Angmo D, Elhai JD, Koot HM. Factor structure of PTSD, and relation with gender in trauma survivors from India. Eur J Psychotraumatology. 2014;5(1):1–11.

20. American Psychiatric Association. Trauma- and Stressor-Related Disorders. In: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition. Arlington, VA: American Psychiatric Association; 2014.

21. King DW, King LA, Gudanowski DM, Vreven DL. Alternative Representations of War Zone Stressors: Relationships to Posttraumatic Stress Disorder in Male and Female Vietnam Veterans. J Abnorm Psychol. 1995;104(1):184–96.

22. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat Duty in Iraq and Afghanistan, Mental Health Problems, and Barriers to Care. N Engl J Med. 2004;351(1):13–22.

23. Grady DA, Woolfolk RL, Budney AJ. Dimensions of War Zone Stress. An Empirical Analysis. J Nerv Ment Dis. 1989;177(6):347–50.

24. Laufer RS, Gallops MS, Frey-Wouters E. War Stress and Trauma: The Vietnam Veteran Experience. J Health Soc Behav. 1984;25(1):65–85.

25. Bell V, Méndez F, Martínez C, Palma PP, Bosch M. Characteristics of the Colombian armed conflict and the mental health of civilians living in active conflict zones. Confl Health. 2012;6(1):10.

26. Farhood L, Dimassi H, Lehtinen T. Exposure to War-Related Traumatic Events, Prevalence of PTSD, and General Psychiatric Morbidity in a Civilian Population From Southern Lebanon. J Transcult Nurs. 2006;17(4):333–40.

27. Wang S-J, Salihu M, Rushiti F, Bala L, Modvig J. Survivors of the war in the Northern Kosovo: violence exposure, risk factors and public health effects of an ethnic conflict. Confl Health. 2010;4(1):11.

28. de Jong K, van der Kam S, Ford N, Hargreaves S, van Oosten R, Cunningham D, et al. The trauma of ongoing conflict and displacement in Chechnya: quantitative assessment of living conditions, and psychosocial and general health status among war displaced in Chechnya and Ingushetia. Confl Health. 2007;1(1):4.

29. Somasundaram DJ, Sivayokan S. War Trauma in a Civilian Population. Br J Psychiatry. 1994;165(4):524–7.

30. Morina N, Ford JD. Complex Sequelae of Psychological Trauma Among Kosovar Civilian War Victims. Int J Soc Psychiatry. 2008;54(5):425–36.

31. Hauff E, Vaglum P. Organised Violence and the Stress of Exile: Predictors of Mental Health in a Community Cohort of Vietnamese Refugees Three Years after Resettlement. Br J Psychiatry. 1995;166(3):360–7.

32. Siriwardhana C, Ali SS, Roberts B, Stewart R. A systematic review of resilience and mental health outcomes of conflict-driven adult forced migrants. Confl Health. 2014;8(1):1–14.

33. Porter M, Haslam N. Predisplacement and Postdisplacement Factors Associated With Mental Health of Refugees and Internally Displaced Persons: A Meta-analysis. JAMA. 2005;294(5):602.

34. Jurado D, Alarcón RD, Martínez-Ortega JM, Mendieta-Marichal Y, Gutiérrez-Rojas L, Gurpegui M. Factors associated with psychological distress or common mental disorders in migrant populations across the world. Rev Psiquiatr Salud Ment Engl Ed. 2017;10(1):45–58.

35. Guyker WM, Donnelly K, Donnelly JP, Dunnam M, Warner GC, Kittleson J, et al. Dimensionality, Reliability, and Validity of the Combat Experiences Scale. Mil Med. 2013;178(4):377–84.

36. Roelfs D, Shor E, Davidson K, Schwartz J. War-related stress exposure and mortality: a meta-analysis. Int J Epidemiol. 2010;39(6):1499–509.

37. Fodor KE, Unterhitzenberger J, Chou C-Y, Kartal D, Leistner S, Milosavljevic M, et al. Is traumatic stress research global? A bibliometric analysis. Eur J Psychotraumatology. 2014;5(1):23269–8.

38. Korinek K, Teerawichitchainan B, Zimmer Z, Brindle E, Nguyen TKC, Nguyen HM, et al. Design and measurement in a study of war exposure, health, and aging: protocol for the Vietnam health and aging study. BMC Public Health. 2019 Dec 1;19(1):1–11.

39. Miguel E, Roland G. The long-run impact of bombing Vietnam. J Dev Econ. 2011;96(1):1–15.

40. Guillemot F. Death and Suffering at First Hand: Youth Shock Brigades during the Vietnam War (1950–1975). J Vietnam Stud. 2009;4(3):17–60.

41. Lang AJ, Wilkins K, Roy-Byrne PP, Golinelli D, Chavira D, Sherbourne C, et al. Abbreviated PTSD Checklist (PCL) as a guide to clinical response. Gen Hosp Psychiatry. 2012;34(4):332–8.

42. Lang AJ, Stein MB. An abbreviated PTSD checklist for use as a screening instrument in primary care. Behav Res Ther. 2005;43(5):585–94.

43. Price M, Szafranski DD, van Stolk-Cooke K, Gros DF. Investigation of abbreviated 4 and 8 item versions of the PTSD Checklist 5. Psychiatry Res. 2016;239:124–30.

44. Brown TA. Confirmatory Factor Analysis for Applied Research. Second. New York: Guilford Press; 2015.

45. Bernstein IH, Teng G. Factoring items and factoring scales are different: Spurious evidence for multidimensionality due to item categorization. Psychol Bull. 1989;105(3):467–77.

46. Fabrigar LR, Wegener DT, MacCallum RC, Strahan EJ. Evaluating the use of exploratory factor analysis in psychological research. Psychol Methods. 1999;4(3):272–99.

47. Osborne JW. Best Practices in Exploratory Factor Analysis. Scotts Valley: CA: CreateSpace Independent Publishing; 2014.

48. StataCorp. Stata 15 Base Reference Manual. College Station, TX: Stata Press; 2017.

49. Harman HH. Modern Factor Analysis. 3rd Ed. Chicago: University of Chicago Press; 1976.

50. DeVellis RF. Scale Development: Theory and Applications. Fourth ed. Thousand Oaks, CA: SAGE Publications; 2017. 280 p.

51. Price LR. Psychometric Methods: Theory into Practice. New York: Guilford Press; 2017.

52. Velicer WF, Jackson DN. Component Analysis versus Common Factor Analysis: Some Further Observations. Multivar Behav Res. 1990;25(1):97–114.

53. Tabachnick BG, Fidell LS. Principal components and factor analysis. In: Using Multivariate Statistics. 7th ed. New York; 2019. p. 476–527.

54. Costello AB, Osborne JW. Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most from Your Analysis. Pract Assess Res Eval. 2005;10(7):1–9.

55. Padilla MA, Divers J. A Comparison of Composite Reliability Estimators. Educ Psychol Meas. 2015;76(3):436–53.

56. Yu C-Y. Evaluating Cutoff Criteria of Model Fit Indices for Latent Variable Models with Binary and Continuous Outcomes. Los Angeles: University of California, Los Angeles; 2002.

57. Hu L tze, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Struct Equ Model Multidiscip J. 2009;6(1):1–55.

58. Fornell C, Larcker DF. Structural Equation Models with Unobservable Variables and Measurement Error: Algebra And Statistics. J Mark Res. 1981;18(3):382–8.

59. Anderson JC, Gerbing DW. Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach. Psychol Bull. 2004;103(3):411–23.

60. Cunningham WA, Preacher KJ, Banaji MR. Implicit Attitude Measures: Consistency, Stability, and Convergent Validity. Psychol Sci. 2001;12(2):163–70.

61. Chen F, Bollen KA, Paxton P, Curran PJ, Kirby JB. Improper Solutions in Structural Equation Models: Causes, Consequences, and Strategies. Sociol Methods Res. 2001;29(4):468–508.

62. Heptinstall E, Sethna V, Taylor E. PTSD and depression in refugee children: Associations with pre-migration trauma and post-migration stress. Eur Child Adolesc Psychiatry. 2004;13(6):373–80.

63. Wilson JP, Smith WK, Johnson SK. A Comparative Analysis of PTSD Among Various Survivor Groups. In: Figley CR, editor. Trauma and Its Wake. Routledge; 2013.

64. Arnoldy B. In Afghanistan, Taliban kills more civilians than US. Christian Science Monitor. 2009 Jul 31; Available from: https://www.csmonitor.com/World/Asia-South-Central/2009/0731/p06s15-wosc.html
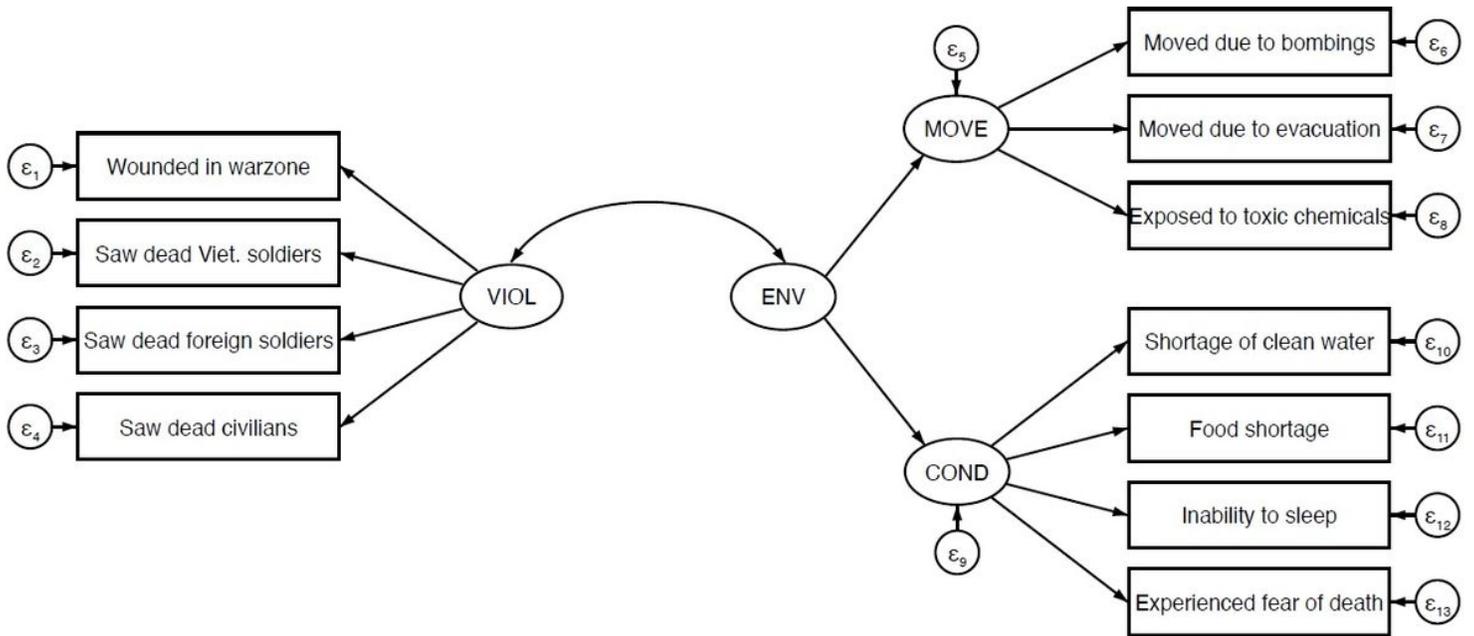
Figures

Figure 1

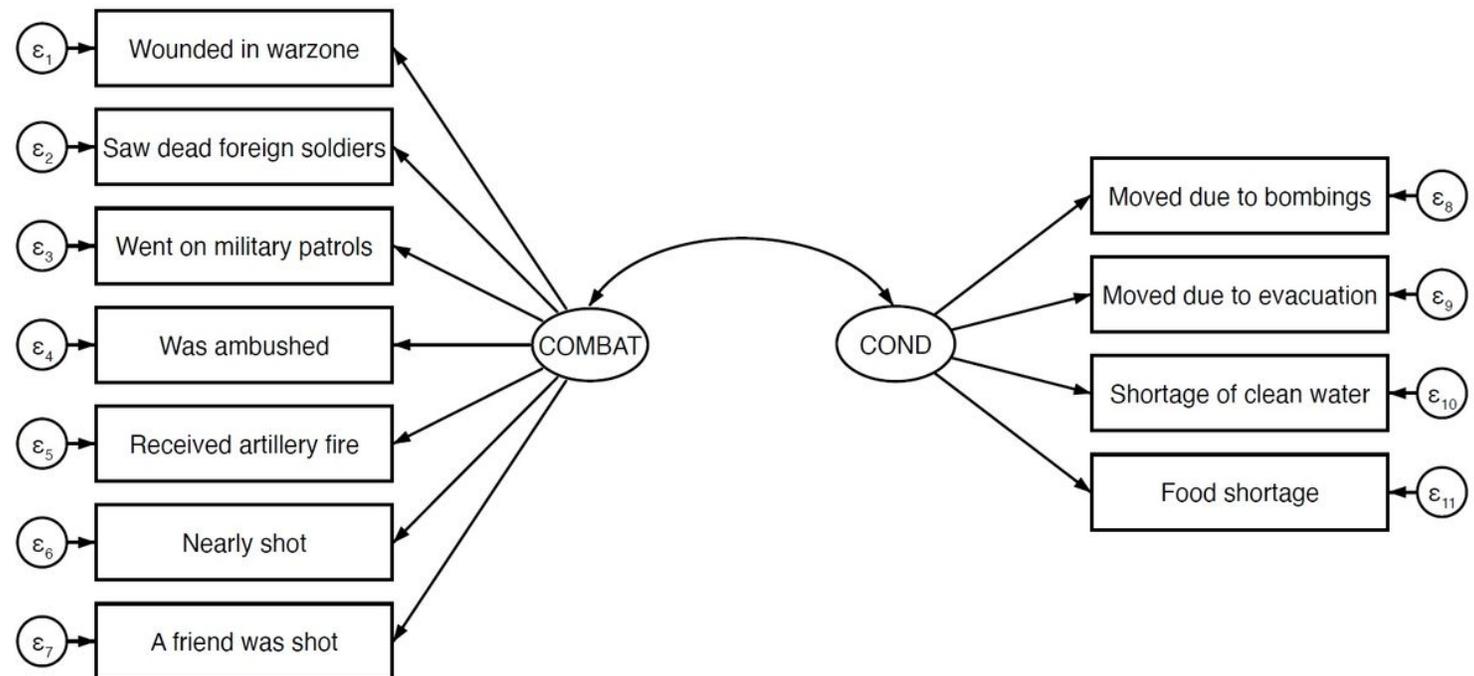Factor Structure of War-related Traumatic Events for Civilians

Figure 2

Factor Structure of War-related Traumatic Events for Participants in Informal Military Activities

Figure 3

Factor Structure of War-related Traumatic Events for Veterans of the Formal Military.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AssessingWarrelatedTraumaExposureAppendices.docx